

ETHICS IN MATHEMATICS SYLLABUS
UNIVERSITY OF CAMBRIDGE
MICHAELMAS 2019

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Description.

This course on Ethics in Mathematics (EiM) aims to give an overview of the sorts of effects mathematicians and mathematical work can have on society, detail the instances where this work can cause harm, and discuss what leads to this work being harmful and what might be done to possibly avert such harm.

This is not a course on ethics or ethical frameworks, nor is it a philosophy course. We will not be discussing *what* is right and wrong, but instead explore the fact that there *is* right and wrong when doing mathematical work. This is a course to raise fundamental ethical awareness among mathematicians, not to give axioms of ethics or an algorithm for ethical decision-making.

The course will be delivered as 8 lectures, each in MR4 at 16:00 on Tuesdays throughout Michaelmas term. Each lecture will begin with about 40 minutes of prepared content, followed by 15 minutes for questions. We will have a brief break at 17:00, and then proceed to discussion which will continue until 18:00 at the latest. Feel free to leave at 17:00 if you have other things to get to or don't want to stay for discussion. However, over the past 4 years it has usually been the case that the most interesting and useful parts of the course for the students have come about during discussion time.

This course forms part of the Cambridge University Ethics in Mathematics Project, full details of which can be found at <https://www.ethics.maths.cam.ac.uk>

Lecture outline.

The 8 lectures of the course are titled as follows:

- (1) An introduction to ethics in mathematics and why it is important.
- (2) Financial mathematics and modelling.
- (3) Cryptography, surveillance and privacy.
- (4) Fairness and impartiality in algorithms and AI.
- (5) Regulation, accountability, and the law.
- (6) Understanding the behaviour of the mathematical community.
- (7) Psychology 101 - how to survive as a mathematician at work.
- (8) Looking into the future, what are the next steps mathematicians can take?

Lecture 1 is an introduction to establish that *This is important*. Lectures 2-4 will cover various examples, in various contexts, of mathematicians behaving in (rather obvious) ethically-dubious ways. This aims to establish in the clearest possible terms that *There exists ethics in mathematics*. In lectures 5-7 we cover the ways in which the world around us may influence and coerce us into unethical behaviour, and that there is no place we can “hide” from such effects. That is, *For all mathematics we do, there are ethical issues to consider*. Finally, in lecture 8, we look at the different extents to which mathematicians can engage in ethical decision making and actions, for *Ethical awareness is not a binary state*.

Reading list.

There are very few written resources relating to ethics in mathematics; as an area of study and understanding it is remarkably new. In terms of textbooks, there is nothing. The closest one can conceivably come is the following book, which is a popular science book (thus *not* written for a mathematical audience):

- C. O’Neill, *Weapons of Math Destruction*, Penguin (2016). 272 pages.

In terms of articles, there are fortunately a few pieces aimed at mathematicians. Most of these are rather short.

- (1) M. Chiodo, T. Clifton, *The Importance of Ethics in Mathematics*, LMS Newsletter **484**, 22–26, September 2019.
<https://www.lms.ac.uk/publications/lms-newsletter-back-issues>
- (2) M. Chiodo, D. Müller, *Mathematicians and Ethical Engagement*, SIAM News **51** No. 9, p.6, November 2018.
<https://sinews.siam.org/Details-Page/mathematicians-and-ethical-engagement>
- (3) M. Chiodo, P. Bursill-Hall, *Four Levels of Ethical Engagement*, Ethics in Mathematics Discussion Papers, 2018/1 (2018). 25 pages.
<http://ethics.maths.cam.ac.uk/pub>
- (4) M. Chiodo, R. Vyas, *The role of ethics in a mathematical education*, Ethics in Mathematics Discussion Papers, 2018/1 (2018). 5 pages.
<http://ethics.maths.cam.ac.uk/pub>
- (5) P. Rogaway, *The Moral Character of Cryptographic Work* (2015). 48 pages.
<https://web.cs.ucdavis.edu/~rogaway/papers/moral-fn.pdf>
- (6) J. Franklin, *A “Professional Issues and Ethics in Mathematics” course*, AustMS Gazette **32** No. 2, 98–100 (2005).
<https://www.austms.org.au/Gazette+Volume+32+Number+2+May+2005>
- (7) C. Praeger, *Math Matters: The Profession of Mathematics*, AustMS Gazette **31** No. 4, 217–221 (2004).
<https://www.austms.org.au/Gazette+Volume+31+Number+4+September+2004>
- (8) B. Schulman, *Is There Enough Poison Gas to Kill the City?: The Teaching of Ethics in Mathematics Classes*, College Math. J. **33**, 118–125 (2002).
- (9) R. Hersch, *Mathematics and ethics*, The Mathematical Intelligencer **12** No. 3, 12–15, June 1990.
<https://link.springer.com/article/10.1007%2F03024013>
<https://core.ac.uk/download/pdf/70985053.pdf>

It would be wise, and easy, to read through the short articles 1, 2, 7, 9, which pretty much brings you up to speed on the “state of the art”. You can look at 6, 8, 4 for discussion on how ethics in mathematics is/might be taught. The longer articles 3 and 5 go in to much deeper discussions about particular ethical issues in mathematics; both are worth a long read. And the book by O’Neill is a fine, if not somewhat superficial and mathematically-lacking, broad introduction into where some ethical issues in mathematics lie.

None of these are required reading for the course, though may be of interest and some use in helping you to put ethics in mathematics into some more context.